

Remarks:

Reconsideration of the application, as amended herein, is respectfully requested.

Claims 5, 7 and 8 are presently pending in the application. Claim 5 has been amended. Claim 6 has been canceled herein. Claims 1 - 4 were previously canceled. New claims 7 - 8 have been added.

On page 2 of the above-identified Office Action, claim 6 was rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U. S. Patent No. 5,668,385 to Bauer et al ("BAUER") in view of German Patent Publication No. 39177769 A1 to Gerstenmaier et al ("GERSTENMAIER"). On page 5 of the above-identified Office Action, claim 5 was rejected under 35 U.S.C. § 103(a) as allegedly being obvious over BAUER in view of U. S. Patent No. 5,684,323 to Tohyama ("TOHYAMA") in view of GERSTENMAIER.

Applicants respectfully traverse the above rejections.

More particularly, claim 6 has been canceled from the instant application, thus mooting the rejection of that claim.

Additionally, Applicants' amended claim 5 recites, a power semiconductor element, comprising:

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an emitter region;

a stop zone in front of said emitter region;

said emitter region and said stop zone having mutually opposite conductivities; and

said stop zone having foreign atoms with at least one energy level within the band gap of the semiconductor and at least 200 meV away from both a conduction band and a valence band of the semiconductor, resulting in said stop zone being only partially electrically active in the on-state and fully electrically active in the off-state. [emphasis added by Applicants]

Applicants' amendment to claim 5 is supported by the specification of the instant application, for example, by paragraph [0024] of the instant application, which states:

However, if the sulfur doped region is surrounded by a space charge region, these sulfur atoms become completely active as double donators, i.e. donators with two released charge carriers, so that a sulfur atom is doubly charged. The energy levels of sulfur lie so low in the silicon band gap that they are only completely electrically activated upon establishing a space charge region: One sulfur energy level lies 260 meV below the conduction band in silicon, and a second energy level lies 480 meV above the valence band. The silicon band gap is 1120 meV. This therefore means that on the one hand, the stop zone is only partially electrically active in the on-state; the partial transistor amplification factor α_{pnp} is therefore depressed only relatively little and the on state voltage can thereby be kept low. The part of the stop zone in the off voltage condition surrounded by the space charge region can on the other hand be completely activated, which therefore results in a very effective stop zone. Therefore, the correlation between on-state voltage and off state voltage is improved. [emphasis added by Applicants]

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As such, it can be seen that the invention of the instant application utilizes the inventive concept that a stop zone needs to be fully "active" only in the off-state of the circuit element, but not during the on-state. The application of Applicants' inventive concept is a stop zone doped with foreign atoms having certain characteristics so that the stop zone is only partially electrically active in the on-state, but fully electrically active in the off-state.

The reference BAUER discloses a power semiconductor component with transparent emitter and stop layer. However, BAUER neither teaches, nor suggests, Applicants' particularly claimed foreign atoms in the stop zone. More particularly, the Office Action states on page 3, in part:

*F. Bauer et al do not teach the further limitation that said atoms of said doping substance have at least one energy level within the band gap of the semiconductor and at least 200 meV away from both a conduction band and a valence band of the semiconductor wherein a number of effective doping atoms generated in the stop zone changes in dependence on whether the power semiconductor element is in a blocking operation or in a conducting operation, and that said foreign atoms comprise selenium atoms.
[emphasis is original]*

Rather, the Office Action goes on to allege that GERSTENMAIER, when combined with BAUER, provides a teaching and motivation that would render the above limitation of Applicants' former obvious. Applicants respectfully disagree.

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First, GERSTENMAIER neither teaches, nor suggests, a stop zone. Rather, GERSTENMAIER discloses placing foreign atoms in portions (11a of Fig. 1 of GERSTENMAIER) of the base (3 of Fig. 1 of GERSTENMAIER), where the foreign atoms are not in front of the emitter, but behind the emitter. See Fig. 1 of GERSTENMAIER.

The Office Action correctly stated on pages 3 - 4, that the foreign atoms of GERSTENMAIER are:

... for the specifically stated purpose to reduce the temperature dependence of the threshold current (cf. abstract and col. 2, l. 30 - col. 3, l. 17) through an increase in the slope of the conductivity versus temperature. [bolding and underlining added by Applicants]

The purpose and function of the foreign atoms in the stop zone of the present invention, as recited in the amended claims, is to have a stop zone that is only partially electrically active in the on-state, but fully electrically active in the off-state.

As stated above, among other limitations of Applicants' claims, BAUER does not teach or suggest putting Applicants' particularly claimed foreign atoms in a stop zone. Further, among other limitations of Applicants' claims GERSTENMAIER does not teach or suggest: 1) placing the foreign atoms in a stop zone (i.e., GERSTENMAIER places the foreign atoms in the

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base, which is a completely different element); 2) placing the foreign atoms in front of the emitter (i.e., GERSTENMAIER teaches placing the foreign atoms behind the emitter); 3) placing the foreign atoms in a different conductivity than the emitter (i.e., GERSTENMAIER discloses placing the foreign atoms in a conductivity region that is the same as the emitter); and 4) providing foreign atoms in the stop zone to have a stop zone that is only partially electrically active in the on-state, but fully electrically active in the off-state (i.e., GERSTENMAIER neither teaches a stop zone, nor teaches that providing stop atoms is for any purpose other than reducing the temperature dependence of the threshold current).

As such, there is nothing in GERSTENMAIER to teach, suggest or motivate its combination with BAUER, or to modify BAUER to render Applicants' amended claims obvious.

In order to argue obviousness over a combination of references there must be *something* in the cited references (or in the knowledge generally available to one of ordinary skill in the art) suggesting that *particular* combination of teachings or features.

Without a recognition of the particular problem solved by the present invention and without a conceptualization of the underlying inventive concept of the present invention (i.e.,

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using foreign atoms of a certain characteristic), neither BAUER, nor GERSTENMAIER, taken alone or in combination, teach, suggest or motivate the addition of foreign atoms into a stop zone in front of the emitter. In fact, considering the different location and purpose of the foreign atoms in GERSTENMAIER, it is likely that a person of ordinary skill in the art reading BAUER and GERSTENMAIER would be taught away from Applicants' claimed invention including foreign atoms added to a stop zone in front of the emitter.

The present invention is in a very mature and tightly covered field of technology with a high level of knowledge and skill. There is ample documentation, properly indexed and/or categorized, in this field of technology. If something in this field of technology has been done before or discussed, it would be quite likely that written documentation would be present in the database of the Patent Office. Yet, no such document evidencing a stop zone with foreign atoms of a certain characteristic was found. This is an additional indication suggesting that the present invention is non-obvious.

The legal standard for establishing a prima facie case of obviousness is "preponderance of evidence". As stated in MPEP § 716.01(d) and § 2142, in order for an obviousness rejection to be made or in order to maintain an obviousness rejection,

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the evidence for obviousness must be more convincing than the evidence against obviousness, i.e. more probable than not.

Looking at the evidence offered against obviousness and the evidence offered for obviousness, Applicants believe that the lack of direct evidence suggesting or motivating the addition of foreign atoms into a stop zone tilts the balance towards non-obviousness.

It is accordingly believed that BAUER and GERSTENMAIER do not show or suggest the features of claim 5. The TOHYAMA reference was additionally cited in the Office Action in combination with BAUER and GERSTENMAIER against Applicants' claim 5, as allegedly teaching the use of sulfur as a dopant. As Applicants' present claim 5 no longer recites that the foreign atoms are sulfur, Applicants' have only addressed the combination of BAUER and GERSTENMAIER when discussing claim 5, above. Note however, that the TOHYAMA reference does not cure the deficiencies discussed herein regarding the combination of BAUER and GERSTENMAIER, as applied to Applicants' claims (i.e., TOHYAMA does not disclose placing foreign atoms of certain characteristics in a stop zone located in front of an emitter region). As such, Applicants' new claim 7, which further recites that the foreign atoms are sulfur atoms, is believed not to be rendered obvious by the combination of BAUER, GERSTENMAIER and TOHYAMA, because, as stated above, the

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combination of those references does not teach, suggest or motivate a modification that places the foreign atoms in a stop zone located in front of an emitter. Further, Applicants' new claim 8 is believed to be patentable over BAUER, TOHYAMA and GERSTENMAIER, taken alone or in combination, for the same reasons discussed in connection with claims 5 and 7.

Additionally with regard to Applicants' new claim 7, as stated in paragraph [0024] of the instant application, the energy level of the sulfur atoms is 260meV below the conduction band in silicon. However, in GERSTENMAIER, the highest donation level is about 300meV below the conduction band in silicon. See, col. 3 of GERSTENMAIER, lines 5-6). Consequently, GERSTENMAIER also differ from the invention recited in claim 7 by using *different* foreign atoms. Thus, the teachings of GERSTENMAIER would be destroyed if the sulfur atoms of TOHYAMA were substituted as the foreign atoms in the base portion of GERSTENMAIER. A modification cannot be made where it destroys the teachings of the reference. As such, claim 7 is further patentable over BAUER, TOHYAMA and GERSTENMAIER.

It is accordingly believed that none of the references, whether taken alone or in any combination, teach or suggest the features of claim 5. Claim 5 is, therefore, believed to

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be patentable over the art. The dependent claims are believed to be patentable as well because they all are ultimately dependent on claim 5.

In view of the foregoing, reconsideration and allowance of claims 5, 7 and 8 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate receiving a telephone call so that, if possible, patentable language can be worked out.

If an extension of time for this paper is required, petition for extension is herewith made.

Please charge any fees that might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner Greenberg Stemer LLP, No. 12-1099.

Respectfully submitted,



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